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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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NIXON PEABODY, LLP
8180 GREENSBORO DRIVE
SUITE 800
MCLEAN, VA 22102

EXAMINER

ANDUJAR, LEONARDO

ART UNIT PAPER NUMBER

2826

DATE MAILED: 12/13/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n N .

09/982,144

Applicant(s)

NAKAGAWA ET AL.

Examiner

Leonardo Andújar

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-- The MAILING DATE of this communication appears on th cover sheet with th correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2002 .
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) 8-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4 .
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____ .

DETAILED ACTION

Acknowledgment

1. The amendment filed on 11/25/2002, paper no. 5, has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 1-11.

Election/Restrictions

2. Applicant's election without traverse of Group I (claims 1-7) in Paper No. 5 is acknowledged.

Priority

3. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on 10/26/2000. The certified copy of the priority document has been received.

Specification

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitch in view of Edelstein et al. (US 6,181,012).

7. Regarding claim 1, Kitch (e.g. 5) shows a semiconductor device comprising: metal interconnects (20, 22) made from a multi-layer film composed of a first metal film 25 deposited on a semiconductor substrate 10 with an insulating film 11 sandwiched therebetween, an interlayer insulating film 30 formed on the metal interconnects, and a plug 28 made of a third metal film over the first metal layer within a via hole formed in the interlayer film. Also, Kitch disclose that copper can be used as a first and a third metal (col. 3/lis. 47-54). In this case a barrier layer is required. However, Kitch does not explicitly teach a seed layer or a second metal film between the first metal film and the third metal film. Edelstein discloses that copper based seed layers are used to improve the adhesion of copper to the barrier layers, electromigration resistant and other surface properties (col. 4/lis. 14-40). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make a copper barrier layer or a second metal layer underlying third metal layer in order to improve the adhesive strength of the third metal layer (i.e. copper) to the barrier layer as well as to improve the electro migration resistant and other surface properties as taught by Edelstein.

8. Regarding claim 2, Kitch in view of Edelstein shows a third metal film formed over the second metal film. In regards to the process of making the third metal film, a "product by process" claim is directed to the product per se, no matter how actually made. See *In re Thorpe et al.*, 227 USPQ 964 (CAFC, 1985) and the related case law cited therein which makes it clear that it is the final product per se which must be

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determined in a "product by process" claim, and not the patentability of the process, and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe, even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. In re Brown, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); In re Pilkington, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); Buono v. Yankee Maid Dress Corp., 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935). In any case, Edelstein teaches that copper can be deposited by many techniques including plating (col. 2/lls.45-65).

9. Regarding claim 3, Kitch discloses that the third metal film is made of copper (col. 3/lls. 47-54). Edelstein discloses that the main constituent of the seed layer is copper (col. 4/lls. 14-40).

10. Regarding claim 4, Kitch in view of Edelstein shows that the second and third metal films are made for copper as a principal constituent. Kitch in view of Edelstein does not use an adhesive layer between the second and third metal films. In regards to the process of making the third metal film, a "product by process" claim is directed to the product per se, no matter how actually made. See In re Thorpe et al., 227 USPQ 964 (CAFC, 1985) and the related case law cited therein which makes it clear that it is the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe, even though product-by-process claims

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are limited by and defined by the process, determination of patentability is based on the product itself. In re Brown, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); In re Pilkington, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); Buono v. Yankee Maid Dress Corp., 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935). In any case, Edelstein teaches that copper can be deposited by many techniques including plating (col. 2/lls.45-65).

11. Regarding claim 5, Kitch discloses an air gap 29 formed between the metal interconnections in the interlayer insulating film.

12. Regarding claim 6, Kitch in view of Edelstein shows a first and second metal, which inherently have resistance values. Kitch in view of Edelstein does not explicitly teach the resistant ratio of the interconnection layers. Nonetheless, it well known in the art those resistance ratios of the interconnection layers are subject to optimization. For example, US 6,136,707 teaches that the requirement for providing a low resistance electrical path is fulfilled by choosing the seed layer to be comprised of an adequately thick, low resistivity material (col. 1/lls. 33-36). In this case, the specific ratio claimed by applicant, i.e., "wherein said first metal film composing said metal interconnect has interconnect resistant substantially $1/5$ /or less of interconnect resistance of said second metal film composing said metal interconnects", absent any criticality, is only considered to be the "optimum" resistant ratio of the metal interconnect layers disclosed by the Prior Art that a person having ordinary skill in the art would have been able to determine using routine experimentation based, among other things, on the desired accuracy, manufacturing costs, low resistance electrical path, etc. (see In re Boesch, 205 USPQ

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215 (CCPA 1980)), and since neither non-obvious nor unexpected results, i.e., results which are different in kind and not in degree from the results of the prior art, will be obtained as long as the interconnection is used as already suggested by the Prior Art.

13. Regarding claim 7, Kitch in view of Edelstein shows a first and second metal, which inherently have resistance values. Kitch in view of Edelstein does not explicitly teach the resistance of the first metal layer is substantially equivalent to the resistance of the second layer. Nonetheless, it is well known in the art that the resistance ratio of the interconnection layers is subject to optimization. For example, US 6,136,707 teaches that the requirement for providing a low resistance electrical path is fulfilled by choosing the seed layer to be comprised of an adequately thick, low resistivity material (col. 1/lls. 33-36). In this case, the specific resistance claimed by applicant, i.e., "wherein said first metal film composing said metal interconnect has interconnect resistance substantially equivalent to interconnect resistance of said second metal film composing said metal interconnects", absent any criticality, is only considered to be the "optimum" resistance ratio of the metal interconnect layers disclosed by the Prior Art that a person having ordinary skill in the art would have been able to determine using routine experimentation based, among other things, on the desired accuracy, manufacturing costs, low resistance electrical path, etc. (see *In re Boesch*, 205 USPQ 215 (CCPA 1980)), and since neither non-obvious nor unexpected results, i.e., results which are different in kind and not in degree from the results of the prior art, will be obtained as long as the interconnection is used as already suggested by the Prior Art.

Conclusion

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14. Papers related to this application may be submitted directly to Art Unit 2826 by facsimile transmission. Papers should be faxed to Art Unit 2826 via the Art Unit 2826 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2826 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2826 Fax Center is to be used only for papers related to Art Unit 2826 applications.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Leonardo Andújar** at **(703) 308-0080** and between the hours of 9:00 AM to 7:30 PM (Eastern Standard Time) Monday through Thursday or by e-mail via Leonardo.Andujar@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn, can be reached on (703) 308-6601.

16. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 305-3900**.

17. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass (es): 257/678, 773, 774, 775; 438/618, 622, 625	12/01
Other Documentation:	
Electronic Database(s): East (USPAT, US PG PUB, JPO, EPO, Derwent, IBM TDB)	12/01

Leonardo Andújar

Patent Examiner Art Unit 2826

LA

12/10/02

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

